5/8/08

BACKGROUND DOCUMENT
FOR
AMENDMENT TO
REGULATIONS 310 CMR 7.00
FOR THE CONTROL OF AIR POLLUTION
IN THE

BERKSHIRE AIR POLLUTION CONTROL DISTRICT
PIONEER VALLEY AIR POLLUTION CONTROL DISTRICT
MERRIMACK VALLEY AIR POLLUTION CONTROL DISTRICT
METROPOLITAN BOSTON AIR POLLUTION CONTROL DISTRICT
CENTRAL MASSACHUSETTS AIR POLLUTION CONTROL DISTRICT
SOUTHEASTERN MASSACHUSETTS AIR POLLUTION CONTROL DISTRICT

STATUTORY AUTHORITY
M.G.L. c. 111, Sections 142A through 142N

OUTDOOR HYDRONIC HEATERS

MAY 8, 2008

Background Document
Regulations for Outdoor Hydronic Heaters
310 CMR 7.00

I. BACKGROUND

The increasing popularity of using outdoor hydronic heaters, or OHHs, in Massachusetts by people trying to reduce heating costs is raising concerns over the impact the units have on local air quality and more importantly, on public heath, particularly to those individuals who are directly impacted by air emissions from nearby OHHs.

OHHs (sometimes known as outdoor wood boilers or OWBs) are wood-fired boilers housed in a small (3-5 feet wide by 6-9 feet deep, and 6-10 feet tall), insulated shed and generally located outside of the building being heated. Units vary in size from 115,000 to 3.2 million British thermal units (Btu) per hour.[1] The firebox in these units is generally oversized (20 –150 cubic feet) so that it can accommodate large loads of wood, reducing the number of times per day the unit needs to be loaded. The firebox is surrounded by a water jacket in which water is heated before it runs through underground pipes to the building being heated. OWBs are equipped with an air damper that operates on a cyclical pattern, opening and closing based on the heat demands of the house or building.

The design and operation of many OHHs can result in the emission of excessive amounts of smoke and particulate matter (PM), which, given the right conditions, can smoke up an entire neighborhood, creating a condition of air pollution and potentially causing health and welfare problems for nearby residents.

Wood smoke contains not only fine particulate matter, but also a variety of toxic compounds associated with incomplete combustion, including carbon monoxide, formaldehyde, benzene, naphthalene and polycyclic aromatic hydrocarbons (PAHs). The particulate matter and toxic compounds can cause significant health problems for people exposed to excessive wood smoke emissions. Fine particles have been shown to cause a variety of serious health problems, especially in people with heart and lung diseases. Breathing in fine particulate matter can aggravate congestive heart failure and coronary artery disease, and lung conditions such as asthma, emphysema and bronchitis. Some of the compounds found in wood smoke can irritate the lungs and some are known or suspected of being carcinogens.[2]

OHHs have neither the equipment to control the combustion process nor controls to reduce or minimize air emissions. Consequently, local nuisance conditions and adverse impacts upon public health in many residential settings are high. This is exacerbated by the fact that OHHs generally release emissions through a low smokestack between 8-12 feet high, which does not adequately promote dispersion of wood smoke. As more units

[1] Assessment of Outdoor Wood-fired Boilers, NESCAUM, 2006
[2] American Lung Association , Residential Wood Combustion, April 24, 1999

have been installed, and installed increasingly in more urban or suburban areas, MassDEP has received many complaints from neighbors of OHH installations about the unhealthy effects of the smoke produced and interference with the use of their property. MassDEP has had to respond both directly to these complaints and also to numerous municipalities asking for assistance in responding to complaints about OHHs that have been installed in the municipality.

MassDEP first received complaints about OHHs in 2001. Since that time, the number of complaints has increased substantially. The number of complaints received tracks the sharp increase Massachusetts and the other New England states are seeing in the number of OHHs being sold annually. Nationally, the number of OHHs in use is growing very rapidly, with about half of all OHHs sold over the past 15 years purchased in 2004 and 2005[3]. NESCAUM estimates that 1,308 OHHs have been sold in Massachusetts since 1990.[4] Since 2002, MassDEP's Western Regional Office in Springfield has received 22 complaints about OHHs from 14 different municipalities. MassDEP's Southeast Regional Office in Lakeville has received 3 complaints from 3 municipalities. In the MassDEP Central Region, 38 municipalities are struggling with and/or have requested assistance from MassDEP to address nuisance complaints about OHHs and eight commercial or residential units have been shut down due to problems they have caused.

There are several factors that contribute to excessive emissions from OHHs. First, a water jacket surrounds the fire-box in most OHH designs and this water jacket cools the combustion chamber, keeping combustion temperatures relatively low. This can result in incomplete combustion, which increases smoke production. Second, this smoke is often released from the boiler through a short smoke stack, typically at a height of approximately 8 - 12 feet above ground. In addition, the plume is not hot enough to rise and mix well with the ambient air, slowing dispersion of the smoke. These factors can result in excessive smoke in the area near the OHH. Third, when the structure being heated has a low demand for heat, an air damper closes to reduce or shut off air to the unit, which creates a smoldering fire resulting in increased incomplete combustion of the wood and the creation of excessive particulate matter and other emissions. These design problems exacerbate emission impacts when:

- OHHs are installed in urban or suburban neighborhoods where the distance between houses does not allow for adequate dispersion of smoke emitted by the units;
- OHH owners do not follow best burn practices in the operation of their units, resulting in excessive smoke;
- Illegal combustible waste materials are burned in OHHs, such as construction debris, painted or treated wood, and household trash;
- Atmospheric conditions do not allow for adequate dispersion of wood smoke, such as during temperature inversions, which are prevalent during the late Fall and early Winter seasons, but may occur at any time of the year; and

[3] Northeast States for Coordinated Air Use Management (NESCAUM) – a regional air pollution control organization comprised of the air program directors of all the New England states, New York and New Jersey.
[4] Appendix B, Issues and Emissions Relating to Outdoor Wood-fired Boilers/Furnaces, NESCAUM, 2005

- Units are used year-round, rather than only during the heating season, to produce hot water and to heat swimming pools. Use in the summer, at the same time that neighbors are spending more time outdoors in their yards and with the windows open in their houses, results in greater exposure of neighbors to smoke from these units.

Because Massachusetts and other New England states were receiving an increasing number of complaints about OHHs and because there was little comprehensive information about OHHs, their emissions and their potential impacts, the Massachusetts Executive Office of Environmental Affairs (EOEA, now EOEEA) provided funding support in 2005 to NESCAUM to develop a report on OHHs. The purpose of the report was to outline the issues, emissions and potential impacts of OHHs. The final report, entitled "Assessment of Outdoor Wood-fired Boilers" was issued in March 2006 and revised in June 2006. The report may be found on the NESCAUM website at: http://www.nescaum.org/documents/assessment-of-outdoor-wood-fired-boilers/

Following the release of the NESCAUM report, NESCAUM, in coordination with a number of states and the USEPA, developed a model rule for regulating OHHs that was released in January 2007. (http://www.nescaum.org/topics/outdoor-hydronic-heaters) The stated purpose of the model rule is to "assist state and local agencies in adopting requirements that will reduce air pollution from outdoor hydronic heaters (e.g., outdoor wood-fired boilers)."

EPA recently established a program through which manufacturers who sign on to the program agree to manufacture cleaner units that meet an EPA emissions standard. However, this is a voluntary program and, therefore, does not apply to manufacturers who do not sign on to the program or to all models of OHHs a manufacturer may sell. In addition, the voluntary emissions standard developed for this program is not as protective of public health as the proposed standards in the NESCAUM Model Rule. At present, 19 manufacturers have signed partnership agreements with EPA and EPA is in the process of reviewing test results for a number of units. EPA maintains a list of those units that meet EPA's voluntary standard at: http://epa.gov/owhh/models.htm

Currently, MassDEP does not specifically regulate OHHs that are less than 1 million Btu's per hour (1MMBtu/hr)[5] through the Massachusetts Air Pollution Control Regulations, 310 CMR 7.00 except when MassDEP receives citizen nuisance complaints. As a result, local governments have stepped in to address local complaints and concerns about the issues presented by unregulated OHHs and have, in many cases, adopted local ordinances and by-laws to regulate or ban OHHs. As of April 2008, 28 municipalities in Massachusetts have either enacted a by-law or an ordinance regulating OHHs that have been approved by MassDEP[6]. Others are in the process of writing

[5] OHHs that are greater than 1 MMBtu/hr require a comprehensive plan approval (CPA) from MassDEP prior to installation and operation of the unit pursuant to 310 CMR 7.02(5)(a)4.

[6] Under M.G.L. c. 111, § 31C, any town may adopt regulations to protect the ambient air, but the regulations must be approved by the MassDEP before the regulations are effective.

regulations at this time. Several of those rules place a moratorium on installation of new OHHs and some require the removal of existing units, or both.

Cities and towns have chosen different approaches to regulating OHHs. For example, in September 2006, Chicopee banned new and existing OHHs while Westborough banned new OHHs and established regulations that would apply to existing units. Tisbury adopted a regulation that requires owners of OHHs to get permits from the board of health; however, the town will only issue permits after the state has certified or approved OHHs. Other municipalities have adopted setbacks that will apply to OHHs[7].

II. PROPOSED REGULATIONS

Air emissions from OHHs can present serious local nuisance problems and potential health and welfare problems for neighbors. There has been a proliferation of these units over the past several years, with many being installed and operated in more populated areas. In order to meet our core mission of protecting public health and the environment, MassDEP has determined that it should develop regulations for OHHs. Taking no action and/or relying on either EPA's voluntary program or on municipalities taking action will be far less effective in ensuring that OHHs are designed and operated properly.

In development of the proposed regulations MassDEP recognizes that burning wood for heat provides a viable alternative source of heat for Massachusetts citizens that utilizes a renewable resource that may be less expensive than oil or natural gas and at the same time reduces the demand for fossil fuels. However, MassDEP believes that manufacturers must take responsibility to produce efficient and clean-burning units to protect public health and the environment. This will require that manufacturers improve the design of OHHs by substantially reducing emissions and greatly improving combustion and heat transfer efficiency so as not to compromise protection of public health and the environment. Improvements in efficiency alone will reduce emissions. In addition, more efficient units burn less fuel, thereby reducing the amount of wood that needs to be harvested and conserving forest resources while at the same time reducing fuel cost for those that purchase wood.

MassDEP is proposing to establish stringent performance standards that manufacturers must meet in order to sell OHHs in Massachusetts. The proposed regulations for OHHs are based on the model rule developed by NESCAUM. The goal of the proposed regulations is to ensure that burning wood in OHHs to heat homes and small businesses is done as cleanly as possible, using properly designed units that operate efficiently. MassDEP is proposing these regulations to:

- Level the Playing Field – all new OHHs purchased and used in Massachusetts should be required to meet stringent emission standards, just as indoor wood stoves are required to do now.[8]

[7] If a municipality has adopted regulations that are not as stringent as MassDEPs, state regulations will control. However, municipalities may be more stringent than the state regulations.

[8] Indoor wood stoves are regulated by EPA under the New Source Performance Standards program and must meet standards of: 7.5 g/hr for non-catalytic appliances and 4.1 g/hr for catalytic appliances.

- Ensure that new and existing OHHs are operated properly using best combustion practices, including burning only seasoned, clean wood fuel.
- Ensure that new OHHs are properly sited so that their air emissions do not negatively impact either neighbors' health or their right to enjoy their property at all times of the year.
- Promote the use of cleaner, more efficient OHHs.

The proposed regulations:

- Are based in part on the model rule developed by NESCAUM
- Establish emission performance standards for units to be sold in Massachusetts after October 1, 2008 that will be implemented in two phases. The emissions standards are technology forcing so that over time the design of units is improved to minimize emissions and improve boiler efficiency;
- Allow units installed prior to the effective date of the regulations to continue to operate provided the unit does not cause a condition of air pollution;
- Establish operational requirements for all owners/operators of new and existing OHHs to ensure that only clean, seasoned wood fuel is burned and limiting operations to the heating season;
- Require manufacturers to test, using a third party testing laboratory, each model they wish to sell in the state and certify that each model meets the applicable emissions standard;
- Establish setback distances, based on USEPA approved computer dispersion modeling for air impacts, for new units that only meet the Phase I emission standards. A minimum setback will be required for both residential and commercial units that meet the Phase II emission standards;
- Establish a variance provision that could be applied to both existing and new units so that owners of OHHs have the opportunity to apply to boards of health for a variance **if** the owner's OHH cannot meet certain operational requirements **and** the unit does not cause a condition of air pollution. The owner must demonstrate to the satisfaction of the Board of Health that his/her situation meets the criteria established for the variance. BOHs may choose not to use the variance process; and
- Clarify that local boards of health, fire departments, and police departments have the authority to enforce certain provisions of this regulation.

III. HOW THE REGULATIONS WORK

The proposed regulations are organized into separate sections addressing specific requirements for owners/operators of OHHs, sellers of OHHs, and manufacturers of OHHs. The regulations address the following major issues:

1. Emission Standards.

The goal of establishing the proposed emission standards is to require the development and manufacture of cleaner, more efficient OHHs that are less likely to cause nuisance conditions and will have less impact on public health and on people's enjoyment of their

property for OHHs to be sold in Massachusetts. The proposed regulations establish particulate emission standards, to be implemented in two phases, for OHHs. OHHs that are less than 1MMBtu/hr are not currently specifically regulated in the Massachusetts Air Pollution Control Regulations, other than under the general nuisance provisions. MassDEP is not aware of any particulate matter emission limits promulgated by other states, except for Vermont and Maine[9], that apply specifically to OHHs, although other states such as New York and Ohio are currently developing draft regulations and the State of Washington adopted a standard that applies to all wood-burning devices in 1995.[10]

The Btu ratings of OHHs generally fall between that of indoor wood stoves, which are smaller in size than OHHs, and larger commercial or industrial-sized wood boilers. Indoor wood stoves are regulated by EPA under 40 CFR Part 60 Subpart AAA, which includes particulate emission limits and manufacturing design requirements. The Subpart AAA residential wood heater standard is 4.1 grams per hour (g/hr) for wood stoves equipped with a catalytic combustor and 7.5 g/hr for wood stoves not equipped with a catalytic combustor. Subpart AAA initially went into effect in 1988. Hand-fired wood boilers greater than 1 million Btu per hour (MMBtu/hr) input are currently regulated by MassDEP (310 CMR 7.02(5)(a)4 of the Massachusetts Air Pollution Control Regulations) and require a plan approval prior to construction that incorporates Best Available Control Technology.

The Phase I and Phase II emission standards proposed in this regulation are the same as the emission standards proposed in the NESCAUM Model Rule. MassDEP, which participated in the development of the Model Rule along with other Northeast states and EPA, concurs with the work that NESCAUM performed in the development of the Model Rule and the regulatory approach proposed. NESCAUM stated that the "major aim of the rule is to meet current federal air quality standards for particulate matter (PM) that are based on PM's extensively documented adverse health impacts to the heart and lungs." The NESCAUM Model Rule and supporting documentation on development of the Model Rule emission standards can be found on the NESCAUM website at: http://www.nescaum.org/topics/outdoor-hydronic-heaters

The proposed Phase I emission standard for particulate matter (PM) is 0.44 pounds per million Btus (lb/MMBtu) heat input for units to be sold after October 1, 2008. The proposed Phase II emission standard for PM is 0.32 lb/MMBtu heat output for units to be sold after March 31, 2010. In addition, Phase II limits total particulate matter emitted to 15 grams per hour for residential units and 20 grams per hour for commercial size units.

MassDEP encourages the development and sale of Phase II-compliant units prior to the Phase II implementation date. Because units installed at a residence and meeting the

[9] Vermont's regulations have a particulate matter standard of 0.44 lb/MMBtu heat input became effective on April 27, 2007 and Maine's regulations have a Phase I standard of 0.60 lb/MMBtu heat input, effective 4/1/08.
[10] The State of Washington standard are two and one-half grams per hour for catalytic woodstoves; and four and one-half grams per hour for all other solid fuel burning devices.

Phase II standard must only meet a minimum setback standard under these regulations[11], whereas those meeting only the Phase I standards are required to meet much more stringent setback distances to the property line and to neighboring houses, there is an incentive for manufacturers to produce, and sellers to sell, units that have been certified to meet the Phase II standard before the Phase II implementation date of March 31, 2010 is reached.

A. Phase I Standard

The Phase I emission standard established in the proposed regulation is 0.44 lb/MMBtu based on heat input.

Limited emissions monitoring data exists specifically from OHHs. The data that is available on emissions from OHHs, summarized in the NESCAUM report, indicates that OHHs can emit PM at anywhere from 18 grams/hr to 269 g/hr, looking at unevaluated emissions data. This compares, for example, with the EPA standard for indoor wood stoves of 4.1 g/hr for units with catalytic combustors and 7.5 g/hr for uncontrolled units and the Washington State Standard for all wood fired units of 4.5 g/hr. However, there is data available from larger sized wood-fired furnaces that, while not directly applicable to OHHs, is nonetheless helpful in comparing to the emissions of a current model OHH and setting performance standards for new OHHs.

MassDEP and NESCAUM reviewed the results of particulate matter emissions tests on three small wood chip fired boilers in Vermont used as examples of typical rates and concentrations of particulate emissions from newer small wood-fired boilers equipped with particulate matter controls. Two of the units, one located at Green Acres Housing Project in Barre Town, Vermont, and the other at Hazen Union High School in Hardwick, Vermont, were tested as part of a project funded in part by the U.S. Department of Energy through the Coalition of Northeastern Governors (CONEG) Policy Research Center, Inc. in 1995. The third boiler, at Vermont Tubbs, Inc. in Brandon, VT, was tested as a requirement of its air pollution control permit. These units are small boilers between 3 and 5 MMBtu/hr but larger than the larger outdoor hydronic heaters. Both the Hazen Union and Vermont Tubbs units also have mechanical collectors that should collect much of the coarse particulate from the exhausts, unlike a typical OHH. Note that the boiler at Vermont Tubbs, Inc. was designed as a starved air gasifier type unit, rather than as a traditional wood-chip boiler. The size of these units and the emissions data resulting from the testing are presented in the table below.

Table 1. Particulate matter emission tests in Vermont

Rated Heat Input (MMBtu/hr)		Emissions lbs/MMBtu Heat input	Emissions Gr/dscf @ 12% CO_2	Emissions lbs/hr
Green Acres	2.2	0.12	0.051	0.15
Hazen Union	2.8	0.098	0.043	0.085

[11] Installation of OHHs will also need to meet any local municipal requirements, which could include setbacks. Commercial installations will need to meet minimum setbacks.

Vermont Tubbs	5.3	0.18	0.08	0.96

For comparison, the MassDEP air pollution regulations, 310 CMR 7.02(8)(h) Particulate Emission Limitations for New Wood boilers, Table 6, regulate new wood fired boilers with a nameplate heat input rating between 3 MMBtu/hr and 25 MMBtu/hr at 0.2 lb/MMBtu (heat input)[12] based on use of a multiclone PM air pollution control device and testing based on filtered front half PM only[13]. However, the test method developed by EPA for certifying OHHs uses a dilution tunnel that collects both front-half filtered PM as well as condensable PM (back-half). Consequently, a 0.44 lb/MMBtu standard that represents both front-half and back-half condensable PM emissions is viewed as a reasonably stringent, yet achievable standard that, in addition to setback and stack height requirements, will better protect human health and welfare in comparison to the PM emissions from current models of OHHs now in use. As the test results in Table 1 indicate, for boilers measuring only front half PM which have controls to collect PM, the 0.2 lb/MMBtu emission limit currently in the Massachusetts Air Pollution Control Regulations is reasonable for compliance purposes. Since the OHHs are not equipped with add-on air pollution controls and compliance will be measured using both front half and back half PM, a 0.44 lb/MMBtu heat input standard is more realistic as an emission standard and has proven most recently to be achievable and sufficiently stringent as a first step in regulating these heaters effectively to control PM emissions.

The Canadian Standards Association (CSA) has adopted a recommended particulate limit and test protocol (CAN/CSA-B415.1-00) for all wood burning devices with heat outputs of up to 2 megawatts (6.83 MMBtu/hr), although the standard is not yet enforceable as a Canadian national or provincial standard. MassDEP is not aware of any OHH models that have yet been certified under the CSA-B415.1 standard at this time. The CSA-B415.1 limit of 0.137 grams per megajoule (g/MJ) (or 0.32 lb/MMBtu) is an energy output based limit.[14]

EPA, under its voluntary program, has reviewed test results for several models of OHHs produced by different manufacturers. Results of these tests may be found on EPA's website at: http://epa.gov/owhh/models.htm As of April, 2008, three of the units listed meet MassDEP's proposed Phase I emission limit and one unit very nearly meets the

[12] This standard does not apply in critical areas of concern. Critical areas of concern require an emission limit of 0.1 lb/MMBtu and covers densely populated cities and towns as determined in 1980.

[13] Particulate matter (PM) is present in two forms, solid particulate matter, which is captured on a filter during a stack test, and condensable particulate matter which captured by cooling the gas stream and capturing the condensed material. The material captured on the filter is known as the "front-half" PM and the condensable material is known as the "back-half" PM.

[14] Converting this limit to an equivalent heat input based limit requires an assumption about the energy efficiency of the combustion device. A 1998 USEPA report on the testing of two outdoor wood-fired boilers ("Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces", EPA-600/R-98-017, February 1998) determined the efficiency of those devices to be roughly 50%. Using that efficiency value, the CSA limit converts to about 0.15 lbs/MMBtu heat input. Assuming a higher efficiency would result in higher limits on the input side that would approach 0.32 lb/MMBtu as the assumed efficiency approaches 100%.

proposed Phase II emission limit. EPA is in the process of reviewing test results for units from other manufacturers and will post the results upon completion of those reviews.

In addition, a company named Clean Wood Heat in Millinocket, ME has a model Blackbear OHH that has been tested by OMNI –Test Laboratories[15] in accordance with the EPA method 28- OWHH test methodology. This OHH also appears to meet the Phase I emission limit, with a weighted average heating season emission result of 0.17 lb/MMBtu.

B. Phase II standard regulatory development

The Phase II PM standard of 0.32 lb/MMBtu based on energy output in conjunction with a mass emission rate of 15 grams/hr for residential units and 20 grams/hr for commercial size units is based upon the NESCAUM model rule. The 0.32 lb/MMBtu output standard represents a more stringent emission limit for PM than the Phase I emission limit[16], based on achieving a 72% thermal efficiency. Increasing the thermal efficiency of an OHH reduces the amount of fuel that needs to be burned by the unit to meet the heat demand of the house or other thermal load. The trend by EPA and MassDEP has been to encourage more efficient combustion equipment designs by implementing output-based standards. The first generation of OHHs now being used by consumers are thermally inefficient, in the range of 28 – 55%[17], requiring more fuel to be burned to heat a house to the same temperature as a more efficient boiler with consequent higher air emissions, which is exacerbated by the cyclical nature of how OHHs operate, resulting in smoke plumes which can cause nuisance and /or public health problems. Having a limit based on heat output rather than input will encourage manufacturers to strive for higher thermal efficiency that will, in turn, reduce mass particulate emissions from a unit.

MassDEP is proposing a Phase II particulate emission limit of 0.32 lb/MMBtu output with no individual certification test run to exceed 15 g/hr for residential units and 20 grams/hr for commercial size units, as contained in the NESCAUM model rule, to encourage higher efficiencies in the design of new OHHs.

As a result of the establishment of emission limits, MassDEP expects OHH manufacturers to move toward more efficient designs, including secondary combustion, to avoid the quenching effect of the water jacket, or toward other designs such as wood gasification in conjunction with secondary combustion in order to meet MassDEP emission standards. Some manufacturers have already taken steps to design their units for more efficient operation. For example, Garn now produces an OHH with a thermal water storage system that allows the OHH to operate at steady state rather than cycling on and off, resulting in a significantly lower particulate emission rate than other current designs that are on the market. Establishing the Phase II emission standard ensures that the next

[15] MassDEP has not received the final test report so data is draft at this point in time.
[16] A 0.23 lb/MMBtu PM emission limit based on heat input and achieving a 72% thermal efficiency equates to 0.32 lb/MMBtu heat output standard.
[17] *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State.* Office of the Attorney General: Albany, NY

generation of OHHs will be more energy efficient and will result in lower particulate emissions than the current generation of less than optimally designed OHHs.

Other manufacturers are now developing new models to respond to the need to meet emission standards being established by states based on the NESCAUM model rule. As noted above, at least one unit, a Central Boiler E-Classic 2300, very nearly meets the draft Phase II standard of 0.32 lb/MMBtu heat input with no individual test run exceeding 15 grams/hour. This second unit had a test run exceeding 15 grams/hour. Based on this information it is clear that manufacturers of OHHs can manufacture units that will meet the proposed standards for both Phase I and Phase II and, with regard to the Phase II standard, have very nearly done so two years before the proposed standard would take effect.

The development of the Phase II emission rates for residential and commercial size OHHs as part of the NESCAUM Model Rule was supported by the modeling efforts of the New York State DEC. NYSDEC conducted a modeling analysis of OHHs dated January 26, 2007 and cited by NESCAUM at: http://www.nescaum.org/topics/outdoor-hydronic-heaters The NYSDEC used EPA's latest AERMOD computer dispersion model (that was recently promulgated as the recommended approach for source specific assessments[18]). The modeling data inputs were based on current emission rates of existing units and field data obtained by NESCAUM during stack testing conducted prior to establishing its model rule. The meteorological data used in this modeling effort included 5-year data sets from three sites in New York. The impact of terrain was modeled only to the extent of plume "impaction" on relatively small features in the vicinity of the OHH exhaust stack.

The NYSDEC conducted the modeling using two different stack heights, one using the unit's actual stack height (10 feet), and the second assuming an 8 foot extension on the actual stack height, for a total stack height of 18 feet from the ground to better disperse the emissions. The modeling was also conducted with and without the influence of a hypothetical nearby building on OHH emissions, so as to model any downwash effects that may or may not occur. The modeling used 15 micrograms per dry standard cubic meter (ug/dscm) as the ambient background level for $PM_{2.5,}$ which is typical of NY State's ambient background conditions. It should be noted, however, that background levels of $PM_{2.5}$ in western Massachusetts are higher, in some cases being close to the recently established National Ambient Air Quality Standard (NAAQS) of 35 ug/dscm[19].

The results of the modeling indicated that the health based, 24-hour $PM_{2.5}$ fine NAAQS standard of 35 ug/dscm will be exceeded in all cases within 500 feet of an OHH with emissions of 161 g/hr (which is the measured particulate emission rate of an existing OHH). In addition, the modeling indicated that an OHH meeting the proposed Phase I emission limit of 0.44 lb/MMBtu heat input, coupled with the NY State background $PM_{2.5}$ level of 15 ug/dscm, still exceeds the 24 hour $PM_{2.5}$ NAAQS in all cases except

[18] Page 2 of the report titled, *Dispersion Modeling Assessment of Impacts of Outdoor Wood Boiler Emissions in Support of NESCAUM's Model Rule.*
[19] 98 percentile of 24-hour concentrations monitored in 2004-2006 in Pittsfield and Springfield .

when the stack height is extended to 18 feet above ground and there is no building of influence[20] nearby to cause exhaust plume downwash effects. Finally, based upon the same modeled inputs as above, an OHH meeting the proposed Phase II particulate emission limit of 0.32 lb/MMBtu heat output and a mass emission rate of 15 g/hr would not result in any exceedances of the $PM_{2.5}$ NAAQS. Therefore, based upon these modeling results, the NESCAUM Model Rule proposes that new units meeting the Phase I limit be required to be located at least 300 feet from a property line and 500 from any occupied dwelling, and have a stack height extending five feet higher than the peak of any roof located within 150 feet. While the NESCAUM Model Rule, based on the above modeling results, does not include any setbacks for a Phase II unit, because Massachusetts has a significantly higher background than NY State for $PM_{2.5,}$ MassDEP is proposing a minimum setback for Phase II units of 50 feet from any property line to account for the higher background of PM and also to ensure that OHHs are not installed in densely populated areas where they are an inappropriate technology.

MassDEP seeks public comment on the following issues in particular:

- **Are the proposed Phase I and Phase II emissions standards stringent enough to protect public health and welfare?**
- **Are the proposed dates for implementation of Phase I and Phase II reasonable?**
- **Given the progress that manufacturers have made in developing units that meet the Phase II standard, should MassDEP go straight to the more protective Phase II standard?**
- **If the proposed implementation dates are not reasonable, what alternative implementation dates would be more appropriate and why?**
- **Are the proposed setbacks for Phase I units reasonable?**
- **Are the proposed setbacks for Phase II units reasonable?**

2. Certification.

The proposed regulations require each manufacturer intending to sell OHHs in Massachusetts to certify that each model of OHH proposed for sale in the state meets the appropriate emission standard. [NOTE: Homeowners are **not** required to certify that their OHH meets the emission standards.] This will require the manufacturer to test each model of OHH that the manufacturer would like to sell in Massachusetts using a third-party testing laboratory in accordance with a standard EPA testing protocol. Units that cannot meet the emission standard cannot be sold in Massachusetts. Upon certification, each model that meets the standard and will be offered for sale in Massachusetts will need to be appropriately labeled in accordance with the regulations.

Retailers may not import, distribute, sell, lease, install or allow installation of an OHH that has not been certified that it meets the appropriate emission standard. Therefore, in-state and out-of-state retailers cannot sell OHHs in Massachusetts unless they have been appropriately certified for sale in Massachusetts.

[20] 5 times the height of the nearby structure

Each OHH unit of a model line that has been certified will need to have a permanent label showing the date of certification and the results of testing in grams per hour and pounds per million Btu. In addition, the unit will need to have a temporary "hang tag" label showing that the unit meets the Phase I or Phase II emission standard. The hang tag must also have graphic representations of the emission rate and efficiency of the model to make it easy for customers to compare units, similar to the energy efficiency hang tags that can be found on major appliances.

The MassDEP Environmental Results Program (ERP) certification process will be the model for the OHH certification process. .

The ERP model requires that a senior company official certify that a facility, or in this case an OHH model, is in compliance with all applicable performance standards. Under the proposed regulation, the manufacturer must certify that each OHH model to be sold in Massachusetts meets either the Phase I or the Phase II emission standard, as applicable. In addition, the third party testing laboratory or the EPA ETV program must also sign the certification statement indicating that the OHH model passed the test. When a certification is submitted to MassDEP, the manufacturer will need to submit supporting documentation, including test results.

The requirement for a manufacturer to test and certify each OHH model to be sold in Massachusetts requires a standardized testing protocol to be used. An American Society for Testing and Materials (ASTM) subcommittee was formed in 2007 to develop a standardized test protocol to be used to measure particulate matter emissions and the thermal efficiency of OHHs for purposes of certification. The ASTM subcommittee includes certified lab operators, state and federal regulators, manufacturers, and consultants. The subcommittee has developed a draft test method that is under review. The next step will be review by the full ASTM committee.

Because the ASTM methodology is not yet an approved ASTM method, the regulations require use of EPA Method 28 OWHH Test Method, which is based on the ASTM draft methodology, and also allows for an alternative test method if approved by MassDEP. EPA's Method 28 is derived from EPA test method 5G for measuring total particulate matter, including condensables, by using a dilution tunnel sampling train that was developed for wood stove certification testing. Wood stoves are regulated by EPA under 40 CFR Part 60 Subpart AAA.

3. Existing OHHs.

MassDEP has considered several options for addressing OHHs that were installed prior to the effective date of the regulations (existing units), in light of the numerous complaints received about these units, the local air pollution problems they often cause and health concerns and health effects resulting from owners and neighbors being subjected to, in some cases, dangerous levels of particulate matter emissions.

While MassDEP has concerns about existing units that are the subject of complaints, MassDEP also recognizes that not all existing OHHs are causing nuisance problems

either because of how they are operated or where they are located. Homeowners and small businesses that previously installed an OHH have made a significant investment in these units that they would like to recover. MassDEP is therefore proposing operational (as opposed to locational) regulations that will apply to existing units as well as to new units. The proposed regulations require that all OHHs (both existing and new) be properly operated, burn only the proper fuel and only operate during the heating season. The proposed regulations do not require setback and stack height requirements for OHHs installed prior to the effective date of the regulations. However, the proposed regulations also make clear that no person may operate an OHH in such a manner as to cause a condition of air pollution[21]. In addition, the proposed regulations clarify that Boards of Health, fire departments and police departments are authorized to take action to correct nuisance conditions resulting from OHHs, whether existing or new, that are causing a condition of air pollution.

The Department of Agricultural Resources (DAR) has pointed out to DEP that farms may be using OHHs for agricultural uses such as heating water used in milking operations, heating buildings that house livestock or heating greenhouses, where placing seasonal limitations on use of an existing OHH to the heating season would be an issue. DAR has suggested that OHHs used on farms for agricultural purposes be allowed without seasonal limitation where such units meet setbacks of 300 feet to the property line and 500 feet to any occupied dwelling or building that it is not serving with a permanent stack extending five feet higher than the peak of any roof structure located within 150 feet of the OHH.

MassDEP seeks comment on:

- **the approach taken in the proposed regulations for addressing existing units;**
- **DAR's proposal to allow year-round use of an OHH that is used for agricultural purposes as long as it meets specified setbacks.**

4. Operational Standards

The regulations include operational standards that must be followed by anyone operating an OHH, whether an existing unit or a new unit that meets the Phase I or Phase II emission standards. The operational requirements include the requirement to burn only seasoned, clean wood or other approved fuels and operate only between October 1 and April 15 each year. There is also an opacity standard that will apply only to commercial sized OHHs (but smaller than 1MMBtu/hr).

[21] AIR POLLUTION means the presence in the ambient air space of one or more air contaminants or combinations thereof in such concentrations and of such duration as to:

(a) cause a nuisance;
(b) be injurious, or be on the basis of current information, potentially injurious to human or animal life, to vegetation, or to property; or
(c) unreasonably interfere with the comfortable enjoyment of life and property or the conduct of business.

The proposed regulations provide a variance provision whereby an owner of either an existing or a new OHH can apply to the Board of Health from specific requirements of the regulations **if** the unit cannot meet the setback or stack height requirement **and** the unit is not causing a condition of air pollution. For example, the OHH owner could apply for a variance from the setback standards that apply to a Phase I unit or from the dates for seasonal operation, but the OHH owner could not apply for a variance from the requirement to burn only clean, seasoned wood in an OHH. It should be noted that a Board of Health may or may not choose to utilize the variance procedures outlined in the regulations. Furthermore, the Board of Health may also choose to establish more stringent regulations than those outlined in the proposed regulations. DAR has proposed to DEP that additional language be added to the variance provision directing a Board of Health to allow the agricultural use of an existing OHH as long as the unit meets specific setback distances of 300 feet to the property line, 500 feet to the nearest occupied dwelling or building that it is not serving and it has a permanent stack extending at least 5 feet higher than the peak of any roof structure located within 150 feet of the OHH.

The regulations specifically state that local Boards of Health, Fire Departments and Police Departments have the authority to implement the OHH regulations as provided for by 310 CMR 7.52 of the Air Pollution Control Regulations.

MassDEP seeks comment on whether the variance provision:

- **is workable for BOHs;**
- **provides too much flexibility to owners/operators of OHHs who can't meet the operational requirements of the regulations;**
- **should be modified to incorporate the Department of Agricultural Resources' suggestions as outlined.**

IV. ECONOMIC IMPACTS

1. Owners/Operators

Current owners of OHHs will not be significantly affected by the proposed rule changes, unless a unit is causing a condition of air pollution, because OHHs that are owned and operated before October 1, 2008 do not have to meet setback or stack height requirements. New OHHs that comply with this rule may not be available for sale or installation in Massachusetts until they meet the Phase I or Phase II standard and are certified for sale. However, prospective purchasers will have available to them a variety of other heating units that can perform the same or similar functions, including: USEPA-certified wood stoves, indoor wood-fired furnaces, and gas or oil fired furnaces and boilers. Most of these alternative heating appliances are less expensive to purchase and install than OHHs. Their costs of operation vary depending on fuel type and availability. The cost to purchasers of new compliant OHHs (when they become available) may increase if the manufacturers decide to pass some or all of the costs of redesigning and upgrading the units on to consumers.

2. Manufacturers, Retailers, Distributors

As proposed, manufacturers of OHHs will need to test each model of OHH intended for sale in Massachusetts to determine whether it meets the Phase I or Phase II emission standard. A typical certification test undertaken by a third party can cost $….. In addition, manufacturers will be required to certify those models that meet the emission standards. There are no known OHH manufacturers in Massachusetts at this time.

There are several dealerships that sell OHHs in Massachusetts, primarily located in central and western Massachusetts. It is not expected that dealerships will incur any additional costs as a result of this regulation. Upon adoption of this regulation, these dealerships will be able to continue to sell OHHs in Massachusetts if the specific models being sold meet the Phase I or Phase II emission standards. While there are currently three OHH models manufactured by two companies that meet the Phase I standard and have been listed on EPA's website, because of the cost and time likely to be required for other OHH manufacturers to redesign their units to meet the new regulation, there may be a temporary reduction in the number of models certified for sale in Massachusetts.

3. MassDEP Resources

The OHH regulation will result in fewer public nuisances and complaints in the future, thereby saving an unquantifiable amount of MassDEP and local municipal inspection and enforcement resources. Enforcement of the emission limit in the rule will require additional MassDEP effort to review and audit certifications submitted by manufacturers. Auditing a certifications may include reviewing testing protocols and reviewing final test reports and certifications. However, these activities can be accomplished using existing MassDEP resources or alternatively by using EPA's Environmental Technology Verification (ETV) program. The main burden for compliance with the rule will be placed on OHH manufacturers (see above) of which none are known to exist in Massachusetts.

V. ENVIRONMENTAL IMPACTS

OHHs are not currently regulated by either EPA or by MassDEP. Adoption of these regulations will therefore have significant positive impacts on the local environment where OHHs are currently in use by prescribing standard operating requirements and fuel requirements and clarifying that OHHs cannot cause a condition of air pollution and that local Boards of Health continue to be authorized to address OHHs that are causing a condition of air pollution. Into the future, the proposed regulations will have a significant and positive local environmental impact by requiring that only certified units that meet a stringent particulate matter emissions standard are sold, installed and operated in Massachusetts. This will be especially important for any neighbors of people who buy a new OHH as the standards should dramatically reduce both complaints neighbors often have with operation of OHHs and potential nuisance and health impacts.

VI. IMPACTS ON OTHER PROGRAMS

1. Toxics Use Reduction

Implementation of toxics use reduction is a Department-wide priority. Toxics use reduction is defined as in-plant practices that reduce or eliminate the total mass of contaminants discharged to the environment. These amendments are not expected to impact on that effort.

2. Air Toxics

In the past, air pollution control programs have focused on the six criteria pollutants: particulate matter, nitrogen oxides, sulfur dioxide, ozone, carbon monoxide, and lead. Recently, concern has been raised over the components of air pollution that are not specifically regulated by programs developed to control criteria pollutants. These compounds are collectively known as air toxics. The health effects of air toxics are wide ranging and can vary from long-term carcinogenic effects to short-term adverse health effects.

The proposed regulations primarily address particulate matter emissions by establishing PM standards that all units sold or installed in Massachusetts must meet. By controlling PM emissions the draft regulations will also result in a decrease in air toxics that are also produced through the burning of wood by promoting more efficient units that burn less wood and burn wood more cleanly.

3. Impacts on Cities and Towns (Proposition 2 1/2)

Pursuant to Executive Order 145, the Department must assess the fiscal impact of new regulations on the Commonwealth's municipalities. The Executive Order was issued in response to Proposition 2 1/2. MGL c. 29 § 27C(a) that requires the state to reimburse municipalities for costs incurred as a consequence of new state laws and regulations.

Many municipalities have already had to expend considerable time and resources addressing complaints about OHHs. Furthermore, many municipalities have already adopted by-laws or regulations to regulate OHHs in the absence of specific MassDEP regulations.

The proposed regulations will establish uniform emission standards that will apply to all OHHs sold in Massachusetts, uniform certification requirements, uniform labeling requirements and a uniform set of operating requirements. Therefore, these regulations should reduce the amount of time municipal boards of health need to spend on this issue because they will be able to regulate OHHs using the proposed regulations. However, BOHs will spend time reviewing variance applications if a municipality decides to use the variance provision. Furthermore, the draft regulations explicitly provide authority to local officials to enforce the provisions of the regulations.

Municipalities that have already adopted rules on OHHs may decide to keep their existing rules in place, or amend their rules in response to these draft regulations, which will also require time and resources.

4. MEPA

This proposed action is "categorically exempt" from the "Regulations Governing the Preparation of Environmental Impact Reports", 301 CMR 11.00, because the proposed amendments will result in an overall reduction in the level of Particulate Matter. All reasonable measures have been taken to minimize adverse impacts.

5. Agricultural Impacts

Massachusetts General Laws, Chapter 30A, Section 18 requires state agencies to evaluate the potential impact of proposed programs on agriculture within the Commonwealth.

1. The reduction in particulate matter and other emissions from OHHs that will result from implementation of this rule will have a positive impact on crop production as a result of the reduction in air contaminants emitted.

2. Where an OHH is currently in use at a farm, and that OHH is being used directly for agricultural purposes such as heating water for milking operations or to heat a barn where livestock are kept, then the proposed regulation may have a negative impact because the proposed regulation places seasonal limits on the use of an OHH unless a waiver is applied for by the farmer and is granted by the local board of health. Placing seasonal limits on use of an existing OHH could result in higher costs for the farmer if he/she needs to provide a different source of heat during the time of year when an existing OHH could not be used. This issue will require MassDEP, in consultation with DAR, to conduct an assessment of this impact before the final rule is promulgated.

VII. IMPLEMENTATION

The proposed regulations will require that MassDEP review certifications submitted by manufacturers for each model unit proposed for sale in Massachusetts. This will be a new activity for which MassDEP will use existing resources.

VIII. PUBLIC PARTICIPATION

As required by M.G.L. c 30A, MassDEP provides notice and provides the opportunity to review background and technical information at least 21 days prior to proposing regulation amendments at a public hearing. To assure more adequate notice for processing a rule as an amendment to the State Implementation Plan (SIP), formal notice will be issued 30 days before the public hearings which will be held: DATE 2008 in Springfield, DATE 2008 in Boston, DATE 2008 in Worcester and DATE 2008 in

Wilmington. The hearing record will be kept open until the close of business on DATE 2008.